SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-41

Name: Lake Sinai **County**: Brookings
Legal Description: T109N- R52W-Sec 3-4, 9-10
Location from nearest town: 1 mile west, 1½ miles north of Sinai, SD

Dates of present survey: July 1-3, 2008 (netting); September 8, 2008 (electrofishing)
Dates of last survey: June 28-30, 2006 (netting); September 25, 2006 (electrofishing)

Primary Game Species	Other Species
Walleye	Black Bullhead
Yellow Perch	Common Carp
Smallmouth Bass	Northern Pike
	Bluegill
	Green Sunfish
	Hybrid Sunfish
	Black Crappie

PHYSICAL DATA

Surface area: 1,719 acres
Maximum depth: 33 feet
Volume: No data
Contour map available: Yes
OHWM elevation: None set
Outlet elevation: None set
Watershed area: No data
Mean depth: 17 feet
Shoreline length: No data
Date mapped: 2002
Date set: NA
Date set: NA
Lake elevation observed during the survey: Full
Beneficial use classifications: (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

Introduction

Lake Sinai is a natural glacial lake located just northwest of the town of Sinai in west central Brookings County. It was named by county commissioners who felt the surrounding land resembled the land around Mount Sinai in the Holy Land. Heavy precipitation in the late 1980s doubled the size of the lake.

Ownership of Lake and Adjacent Lakeshore Properties

Lake Sinai is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages Game Production Areas and Lake Access Areas on the north, south, and east sides of the lake. The remainder of the shoreline is privately owned.

Fishing Access

The North Lake Access Area has a double lane boat ramp with a dock, a large parking area, and a public toilet. There is limited shore fishing access. The East Lake Access Area is flooded and unusable.

Field Observations of Water Quality and Aquatic Vegetation

Water clarity was excellent with a Secchi depth measurement of 3 m (118 in). Some suspended algae and beds of sago pondweed (*Potamogeton pectinatus*) were observed around the lake and there are still considerable areas of flooded trees and brush.

BIOLOGICAL DATA

Methods:

Lake Sinai was sampled on July 1-3, 2008 with five overnight gill-net sets and 10 overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh (¾ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting. Two hours of nighttime electrofishing were done on September 8, 2008 to evaluate walleye recruitment. Sampling sites are displayed in Figure 4. From the gill-net catch, otoliths (walleyes) and scales (yellow perch) were collected and aged for 5 fish in each 10-mm increment in order to estimate growth rates and age structure.

Results and Discussion:

Gill Net Catch

Yellow perch (51.5%) and walleye (43.2%) were the most common species sampled in the gill nets this year and totaled 94.7% of the sample. Smallmouth bass, common carp, and northern pike (Table 1) were also sampled.

Table 1. Total catch from five overnight gill net sets at Lake Sinai, Brookings County, July 1-3, 2008.

Species	No.	%	CPUE[1]	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	68	51.5	13.6	±6.5	54.9	52	19	101
Walleye	57	43.2	11.4	±4.6	14.9	12	7	82
Smallmouth Bass	5	3.8	1.0	±0.6	0.2	--	--	--
Common Carp	1	0.8	0.2	±0.3	1.6	--	--	--
Northern Pike	1	0.8	0.2	±0.3	0.9	--	--	--

*10 years (1998-2007)

[1] See Appendix A for definitions of CPUE, PSD, RSD-P, and mean Wr.

Trap Net Catch

Smallmouth bass (41.8%), walleye (29.1%), and yellow perch (18.2%) were the most abundant species in the trap net sample (Table 2). Other species sampled included, bluegill, black bullhead, common carp, and green sunfish. The total number of fish captured in the trap nets was low (only 11 fish/net average).

Table 2. Total catch from ten overnight trap net sets at Lake Sinai, Brookings County, July 1-3, 2008.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Smallmouth Bass	46	41.8	4.6	±1.9	1.4	42	25	109
Walleye	32	29.1	3.2	±1.5	1.9	25	6	86
Yellow Perch	20	18.2	2.0	±1.3	10.3	24	0	105
Bluegill	4	3.6	0.4	±0.3	0.6	--	--	--
Black Bullhead	3	2.7	0.3	±0.3	116.3	--	--	--
Common Carp	3	2.7	0.3	±0.2	1.8	--	--	--
Green Sunfish	2	1.8	0.2	±0.2	0.3	--	--	--

*6 years (2002-2007)

Walleye

Management objective: Maintain a walleye population with a gill-net CPUE of at least 20, a PSD range of 30-60, and a growth rate of 14 inches by age-3.

Walleye gill-net CPUE increased in 2008 but remains below the management objective and the ten-year average (Table 3). Fish from a strong 2006 year class comprised the majority of the sample. The mean length of walleyes sampled was 30 cm (12 in) (Table 4) (Figure 1).

Walleyes are growing reasonably well with age-2+ fish averaging about 300 mm (12 in) in their third season of growth (Table 4). Walleye condition (mean Wr) was at the low end of the 10-year range in 2008 (Table 3).

Table 3. Walleye gill-net CPUE, PSD, RSD-P, and mean Wr in Lake Sinai, Brookings County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE	17.4	18.3	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4	14.9
PSD	25	67	2	62	71	64	48	46	46	12	45
RSD-P	0	17	0	1	7	18	10	14	15	7	9
Mean Wr	85	84	98	98	84	84	87	86	89	82	88

*10 years (1997-2006)

Table 4. Weighted mean length at capture (mm) for walleye captured in gill nets in Lake Sinai, Brookings County, 2003-2008. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2008	208	299	--	404	--	--	573	--	--	--	655	--
(57)	(14)	(36)		(4)			(2)				(1)	
2007	221	--	345	--	467	--	567	--	--	--	--	--
(22)	(10)		(5)		(6)		(1)					
2006	--	284	395	422	489	554	585	654	--	--	--	--
(37)		(20)	(4)	(5)	(2)	(2)	(1)	(3)				
2005	194	314	364	409	440	661	--	687	--	--	--	--
(35)	(14)	(6)	(6)	(5)	(2)	(1)		(1)				
2004	251	341	408	406	537	553	615	--	704	--	--	--
(24)	(4)	(5)	(8)	(3)	(1)	(1)	(1)		(1)			
2003	215	339	422	502	455	558	606	--	--	--	--	--
(59)	(1)	(17)	(5)	(1)	(32)	(2)	(1)					

Electrofishing indicated that a moderate year class was naturally produced in 2008. The CPH of age-1 walleyes was high suggesting good survival of fish from the moderately-strong 2007 year class. Size and condition of fish were average; however, first-year growth of fish from weak to moderate year classes has generally been faster in Lake Sinai. Size and condition of age-1 walleyes were at the bottom of the range.

Table 5. Age-0 and age-1 walleyes sampled during 2 hours of nighttime electrofishing on Lake Sinai, Brookings County, 2000-2008.

Year	Stocking	Age-0 CPH	80% C.I.	% stocked	Mean length (range; mm)	Wr	Age-1 CPH	80% C.I.	Mean length (range; mm)	Wr
2008	none	31	21-41		162 (135-185)	100	34	25-43	249 (205-290)	81
2007	none	113	63-139		161 (122-203)	95	17	11-23	282 (251-340)	79
2006	fingerling	291	199-393	96	175 (149-221)	85	0	--	-- --	--
2005	none	9	5-13		194 (163-212)	90	64	42-84	251 (223-294)	81
2004	fingerling	87	35-139	[1]	134 (110-160)	95	4	1-6	294 (270-314)	90
2003	none	19	12-26		209 (198-223)	101	22	18-26	317 (274-354)	87
2002	none	122	102-141		180 (147-206)	97	12	4-21	282 (200-315)	90
2001	none	59	36-81		169 (138-222)	105	6	3-9	324 (311-339)	97
2000	none	5	2-8		162 (152-174)	80	1	0-2	195	67

[1] Oxymarine killed immersed fingerlings so no marking of stocked fish was done.

Yellow Perch

Management objective: Maintain a yellow perch population with a gill-net CPUE of at least 50 with a PSD range of 30-60.

Yellow perch gill-net CPUE remains well below the management objective (Table 6). The perch sampled ranged in length from 12-29 cm (4.7-11.4 in) and were 1-3 years old (Figure 2 and Table 7). Growth is faster than regional, statewide and large lakes means (Table 7) with fish reaching 20 cm (8 in) between age-2 and age-3. Yellow perch relative weight (Wr) is near the ten year mean at 101.

Table 6. Yellow perch gill-net CPUE, PSD, RSD-P and mean Wr in Lake Sinai, Brookings County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE	37.4	82.0	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6	54.9
PSD	33	59	94	70	24	82	85	76	73	52	68
RSD-P	8	10	10	26	1	0	28	23	2	19	11
Mean Wr	105	108	97	111	94	99	107	98	107	101	103

*10 years (1997-2006)

Table 7. Average back-calculated lengths (mm) for each age class of yellow perch in Lake Sinai, Brookings County, 2008.

			Back-calculation Age							
Year Class	Age	N	1	2	3	4	5	6	7	8
2007	1	40	101							
2006	2	13	89	205						
2005	3	14	85	190	242					
All Classes		**67**	**91**	**198**	**242**					
Statewide Mean			86	145	190	220				
Region III Mean			94	159	208	242				
LLI Mean			86	146	192	225				

Black Bullhead

Management objective: Maintain a black bullhead population with a trap net CPUE of no more than 100.

Bullhead abundance has declined continuously since 2002 (Table 8) when it was the most abundant species in the survey. Only 3 fish were sampled this year and they averaged 36 cm (14.2 in) long (Figure 3). A lack of recruitment in recent years has produced the decline.

Table 8. Black bullhead trap-net CPUE, PSD, RSD-P, mean Wr and mean length in Lake Sinai, Brookings County, 1999-2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean*
CPUE				634.0	45.5	9.9	3.9	2.5	1.8	0.3	116.3
PSD				56	29	95	100	100	100	--	80
RSD-P				35	15	74	77	92	94	--	65
Mean Wr				92	90	93	97	94	95	--	94
Mean Length mm				279	191	227	310	326	343	361	279

*6 years (2002-2007)

All Species

CPUE for most species was lower in 2008 (Table 9) while walleye and yellow perch increased slightly. Rough fish are not a problem in Lake Sinai at this time.

Table 9. Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Lake Sinai, Brookings County, 1999-2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
COC (GN)	--	--	--	5.2	3.0	4.8	1.2	1.2	--	0.2
COC (TN)	*	*	*	2.0	5.2	1.7	0.9	0.1	1.0	0.3
BLB (GN)	108.2	134.7	39.8	49.5	32.3	5.3	0.2	0.2	0.5	--
BLB (TN)	*	*	*	634.0	45.5	9.9	3.9	2.5	1.8	0.3
NOP (GN)	2.4	--	1.7	0.5	1.5	0.3	0.7	0.8	--	0.2
NOP (TN)	*	*	*	--	0.1	0.1	0.4	--	0.3	--
GSF (GN)	--	--	--	--	--	--	--	--	--	--
GSF (TN)	*	*	*	1.1	--	--	0.1	--	0.3	0.2
HYB (GN)	--	--	--	--	--	--	--	--	--	--
HYB (TN)	*	*	*	0.4	0.1	0.1	--	--	0.1	--
BLG (GN)	--	--	--	--	--	--	--	--	--	--
BLG (TN)	*	*	*	0.4	0.2	0.2	0.2	0.8	1.9	0.4
SMB (GN)	--	--	--	--	--	--	0.3	0.2	1.0	1.0
SMB (TN)	*	*	*	--	--	0.2	0.9	2.0	5.2	4.6
BLC (GN)	--	--	--	--	--	--	--	0.2	--	--
BLC (TN)	*	*	*	--	--	--	--	0.9	0.2	--
YEP (GN)	37.4	82.0	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6
YEP (TN)	*	*	*	42.8	6.6	2.6	6.4	1.8	1.5	2.0
WAE (GN)	17.4	18.3	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4
WAE (TN)	*	*	*	0.5	1.4	0.8	1.1	1.8	5.6	3.2

*Trap nets were not used from 1998-2001

COC (Common Carp), BLB (Black Bullhead), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), SMB (Smallmouth Bass), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

Creel Survey Results

Summer fishing pressure was similar from 2005 through 2008 (Table 10). In 2008, fishing pressure showed a slight increase throughout the summer and peaked in August. Sinai anglers primarily targeted walleyes (92%), over 95% of angling parties were South Dakota residents.

Walleye catch/harvest and catch rate/harvest rates in 2008 were all similar to 2007. Anglers harvested only about a third of their catch, and nearly 70% of the walleyes harvested were less than 14-inches long (Figure 3).

Yellow perch harvest and harvest rates continued to decline; however, catch was up from 2007. Smallmouth bass catch and catch rates have shown a steady increase. Anglers harvested only a small percentage of their catch and nearly 80% of the bass harvested were less than 12 inches long (Figure 3).

Angling parties were asked the question, "What would you consider to be the best daily limit for panfish (perch, crappies, and bluegills)?" The percent that responded to each of the following choices was as follows: 5 (0%), 10 (2%), 15 (13%), 20 (43%), 25 (39%) and 25+ (3%). The response pattern for summer Thompson-Sinai anglers was different than for other creel surveys, with a substantially higher percentage of anglers favoring daily bag limits of 15 or more. Reasons for this difference are not clear.

Table 10. Estimates of fishing pressure and catch (harvest) of fish on Lake Sinai from May through August 2005-2008.

Year	Pressure (h)	Walleye Catch (Harvest)	Yellow Perch Catch (Harvest)	Northern Pike Catch (Harvest)	Smallmouth Bass Catch (Harvest)	Bluegill Catch(Harvest)
2008	20,090	9,946 (2,969)	5,318 (2,112)	7 (7)	5,321 (703)	75 (75)
2007	18,031	8,721 (1,256)	1,070 (770)	76 (31)	2,174 (398)	43 (17)
2006	20,947	16,716 (2,131)	8,360 (5,818)	30 (0)	3,042 (327)	1,544 (22)
2005	20,541	5,433 (1,184)	10,831 (8,699)	129 (24)	1,082 (186)	100 (46)

Table 11. Number of interviews and estimates of catch and harvest rates (number/hour) on Lake Sinai from May through August 2005-2008.

Year	Number of Interviews	Walleye Catch (Harvest)	Yellow Perch Catch (Harvest)	Northern Pike Catch (Harvest)	Smallmouth Bass Catch (Harvest)	Bluegill Catch(Harvest)
2008	176	0.50 (0.15)	0.26 (0.07)	0.0003 (0.0003)	0.26 (0.04)	0.004 (0.004)
2007	284	0.48 (0.16)	0.06 (0.04)	0.004 (0.001)	0.12 (0.02)	0.002 (0.001)
2006	259	0.80 (0.10)	0.40 (0.28)	0.001 (0)	0.15 (0.02)	0.07 (0.001)
2005	470	0.27 (0.06)	0.53 (0.42)	0.006 (0.001)	0.05 (0.01)	0.001 (0.001)

Table 12. Stocking record for Lake Sinai, Brookings County, 1991-2008.

Year	Number	Species	Size
1991	32,115	Yellow Perch	Fingerling
1992	30,399	Yellow Perch	Fingerling
	22,480	Walleye	Lrg. Fingerling
1993	19,644	Walleye	Lrg. Fingerling
1994	30,950	Bluegill	Fingerling
	19,268	Walleye	Lrg. Fingerling
1995	32,000	Bluegill	Fingerling
	60,000	Largemouth Bass	Fingerling
1996	1,994	Bluegill	Fingerling
	192,540	Walleye	Fingerling
1998	2,400,000	Walleye	Fry
1999	11,689	Yellow Perch	Adult
2002	65	Smallmouth Bass	Adult
2003	57,470	Smallmouth Bass	Fingerling
2004	170,200	Walleye	Fingerling
	13,440	Smallmouth Bass	Fingerling
2005	58,340	Smallmouth Bass	Fingerling
2006	173,060	Walleye	Fingerling

MANAGEMENT RECOMMENDATIONS

1. Monitor the Lake Sinai fishery by conducting annual summer netting surveys to monitor the general fish population, fall electrofishing surveys to monitor walleye recruitment.

2. Achieve the walleye management objective stocking fry or fingerlings into voids of natural reproduction as determined by fall electrofishing surveys.

3. Consider stocking fry, fingerling, or adult yellow perch if natural reproduction fails to maintain population density at objective levels.

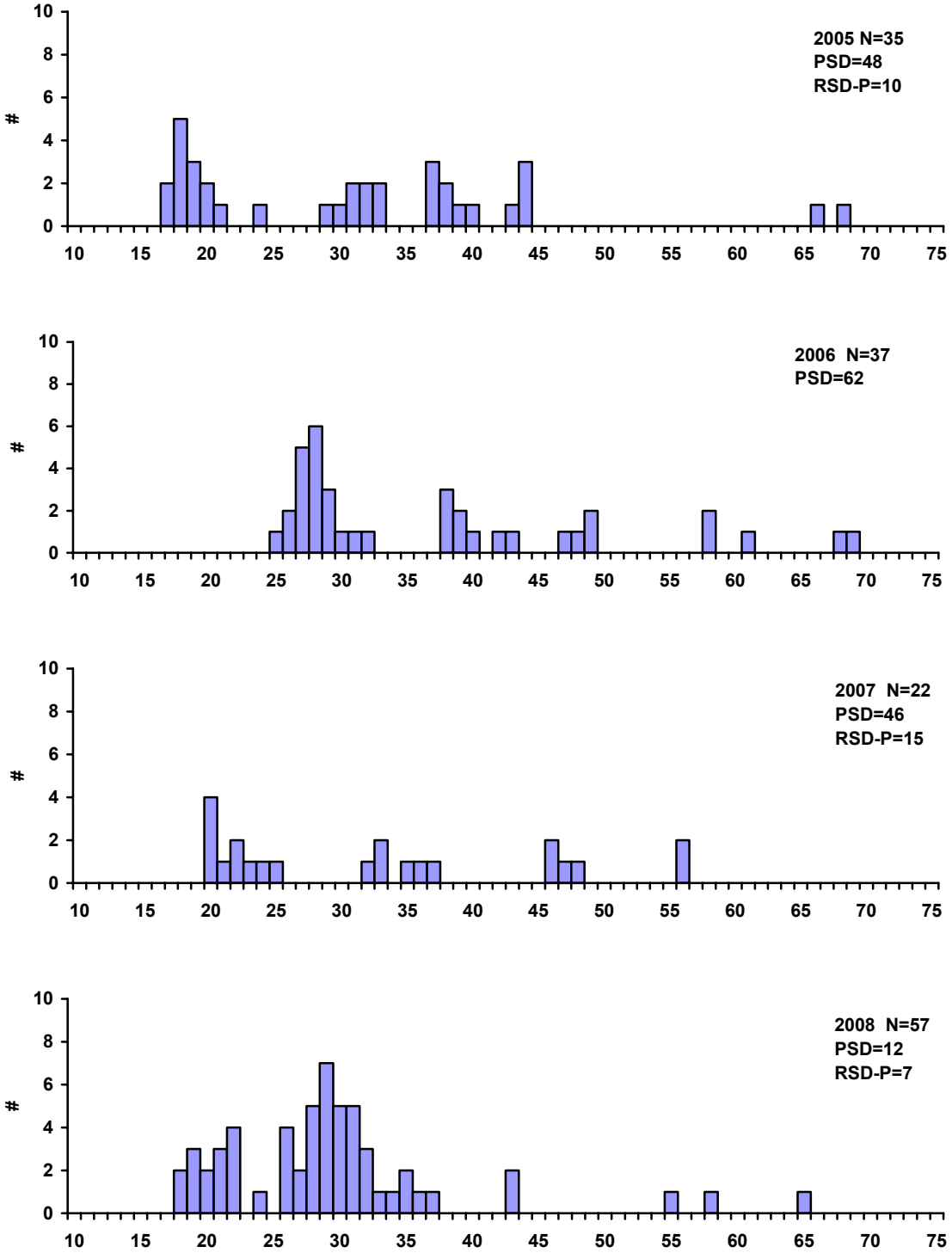


Figure 1. Length frequency histograms for walleyes sampled with gill nets in Lake Sinai, Brookings County, 2005-2008.

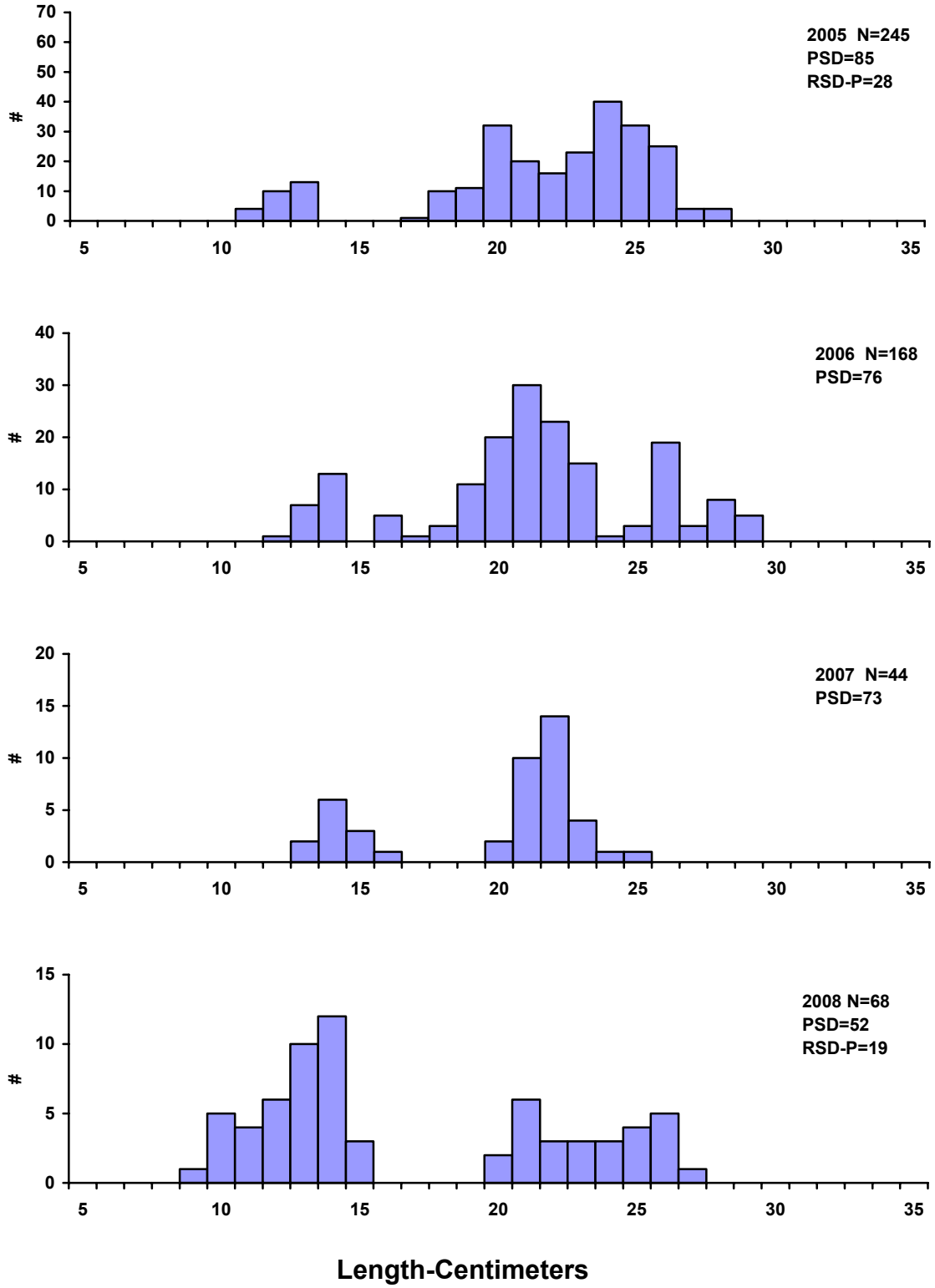


Figure 2. Length frequency histograms for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2005-2008.

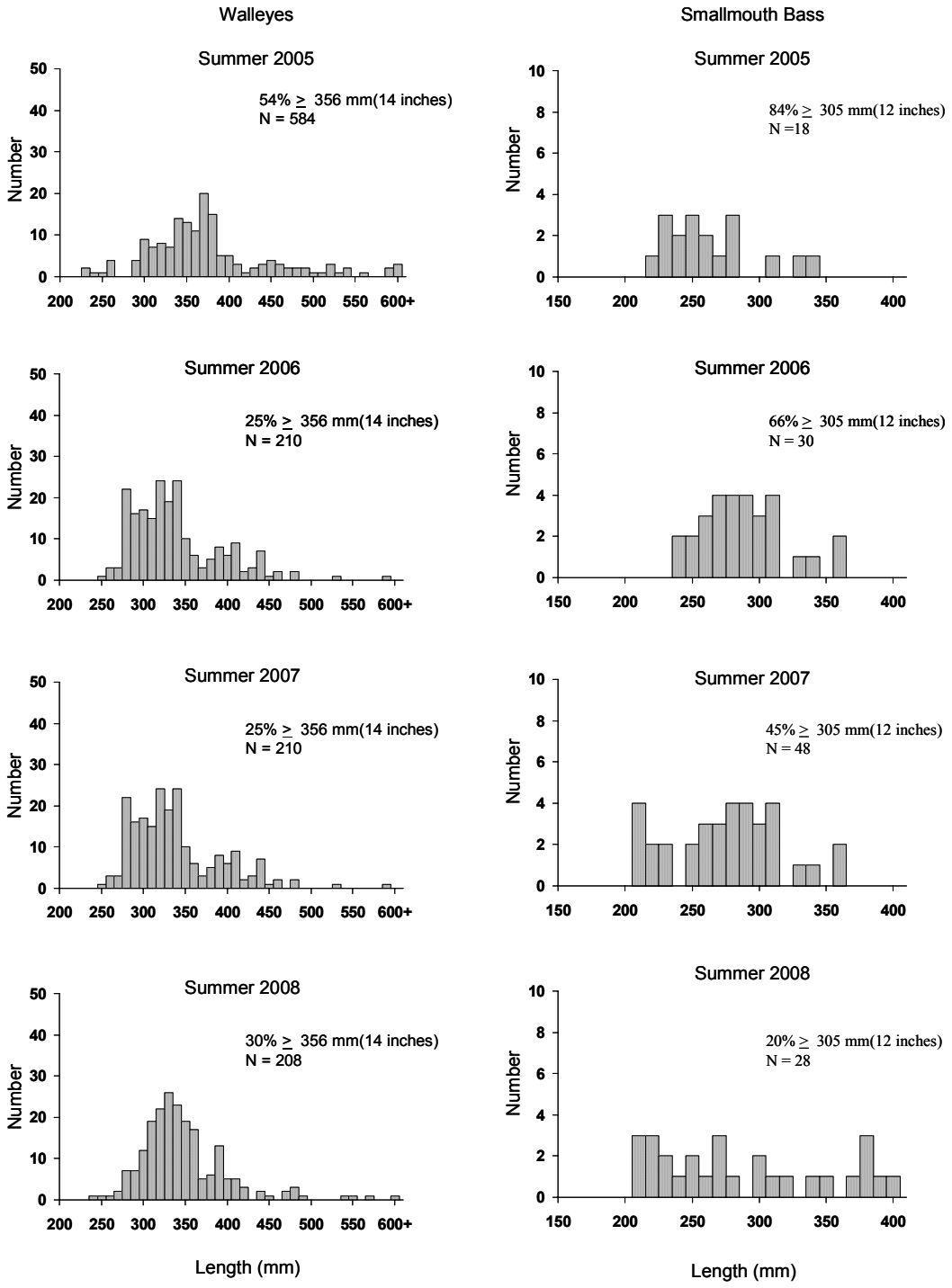
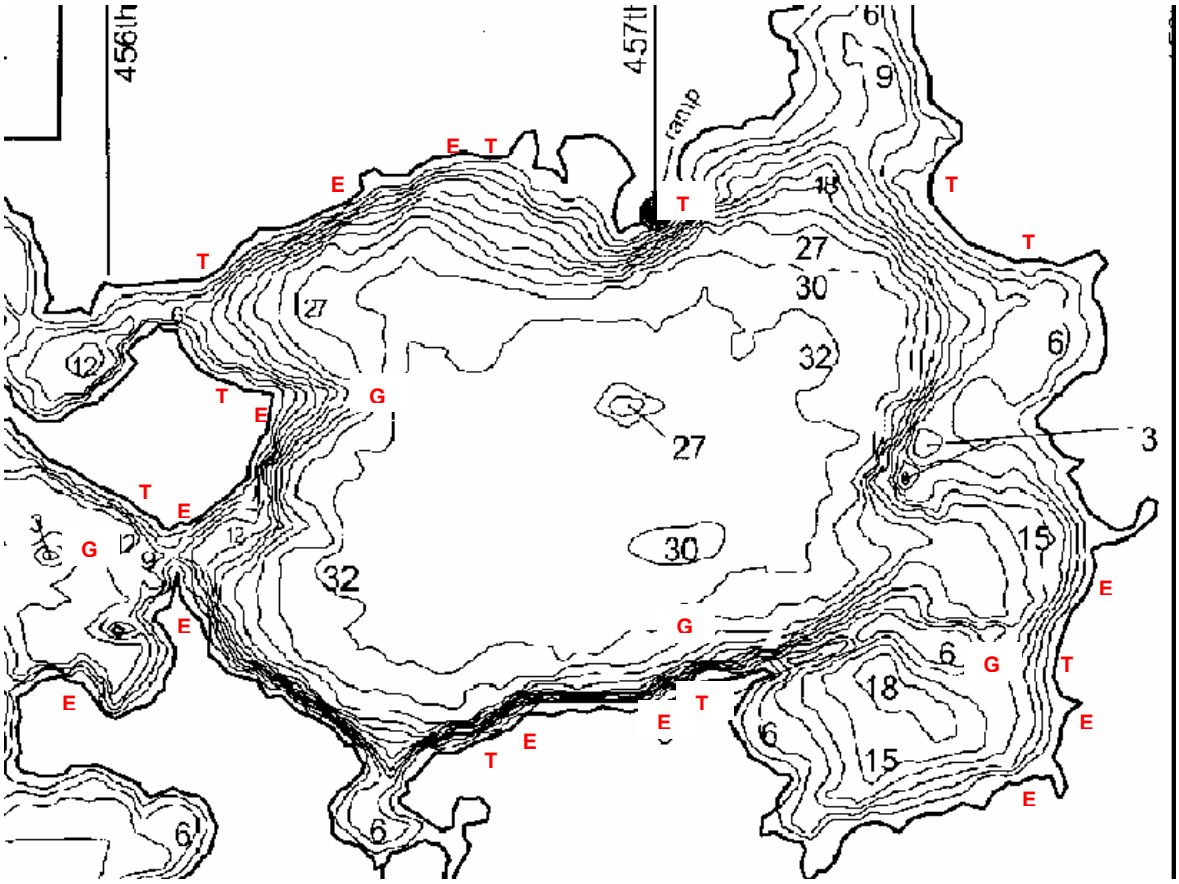


Figure 3. Length frequency of angler-harvested walleyes and smallmouth bass measured by the creel clerk during summer creel surveys on Lake Sinai, 2005-2008.



Legend
Gill Net Sites: G
Trap Net Sites: T
Electrofishing Sites: E

Figure 4. Sampling locations on Lake Sinai, Brookings County, 2008.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$RSD\text{-}P = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.